

REMARKS/ARGUMENTS

In response to the Office Action dated December 30, 2003, claim 21 is amended, and claims 8, 9, and 23 are canceled without prejudice, waiver, or disclaimer to the subject matter contained therein. Claims 1, 2, 4-7, 13-22, 24, and 25 remain in the application. It is not the Applicants' intent to surrender any equivalents because of the amendments or arguments made herein. Reexamination and reconsideration of the application are respectfully requested.

Art-Based Rejections

In paragraphs 1-2 of the Office Action, claims 1-2, 4-8, 13-19, and 22 were rejected under 35 U.S.C. § 102(e) as being anticipated by MacLeish et al., USPN 5,653,808.

In paragraph 3 of the Office Action, claims 8, 9, and 23 were rejected under 35 U.S.C. § 102(e) as being anticipated by Okayama et al., USPN 6,334,983.

In paragraph 4 of the Office Action, claims 20, 21, and 25 were rejected under 35 U.S.C. § 102(b) as being anticipated by Hisashi, JP 05291154.

In paragraphs 5-6 of the Office Action, claim 24 was rejected under 35 U.S.C. § 103(a) as being unpatentable over MacLeish et al., USPN 5,653,808.

The Applicant respectfully traverses the rejections, however, in order to expedite prosecution, the Applicants have amended the claims for clarification. The Applicants respectfully submit that the claims are patentable in light of the clarifying amendments above and the arguments below.

The MacLeish Reference

The MacLeish reference discloses a gas injection system for CVD reactors. A portion of the top surface of susceptor 50 is recessed such that a minimum number of points along the outer edge of wafer 52 need be in intimate contact with susceptor 50 while wafer 52 rests thereon, thereby minimizing conductive heat transfer between susceptor 50 and wafer 52. In some embodiments, susceptor 50 has a dish-shaped cavity 51a formed therein, as shown in FIG. 3A, while in other embodiments the recessed portion of susceptor 50 preferably has an angled wall 51b sloping down to a linear recessed surface 51c, as shown in FIG. 3B. The susceptor 50 shown in FIG. 3B is preferred since linear surface 51c allows for a more uniform spacing between susceptor 50 and a wafer than does the dish-shaped cavity 51a of susceptor 50 shown in FIG. 3A.

When resting on susceptor 50 as shown in FIG. 2, the bottom surface of wafer 52 is approximately 3-5 mils above the top surface of susceptor 50. The top surface of wafer 52 should be substantially flush with the top surface of the outer lip 50a of susceptor 50. For example, in some embodiments the top surface of wafer 52 can be within $\pm .80$ mills of the top surface of outer lip 50a of susceptor 50 and can be considered substantially flush. Susceptor 50 has three openings formed therein through which three quartz or silicon carbide pins 54 protrude so as to, when desired, lift wafer 52 off susceptor 50 (only one of pins 54 is shown in FIG. 1 for simplicity).

Wafer 52 is loaded onto pins 54 via a mechanical robot (not shown) through openings 14c and 22a. The first motor is operated to raise housing 42, which in turn raises shaft 48 and susceptor 50, to an elevated position. As housing 42 is raised toward the top of chamber 34, i.e. toward dish 36, the second motor is activated and elevates susceptor 50 away from housing 42. Susceptor 50 gently lifts wafer 52 off pins 54 and cradles wafer 52 in its recessed portion as described earlier with respect

to FIGS. 3A and 3B. In this manner, wafer 52, susceptor 50 and housing 42 are elevated into the processing position shown in FIG. 2. See Col. 5, lines 6-43.

The Okayama Reference

The Okayama reference discloses a processing system. The processing system has an upper electrode with gas discharge holes of a shape corresponding to the external we of insulating members. See Abstract.

The Hisashi Reference

The Hisashi reference discloses a method and device for forming a single wafer. The wafer 4 is carried in from a wafer inlet and outlet 8 while the mounting part 13A of a rotary and lifting mechanism 12 is lifted to shift the wafer 4 to the mounting part 13A and then the wafer 4 is shifted to a susceptor 2 by lowering the mechanism 13. See Constitution.

The Claims are Patentable over the Cited Reference

The claims of the present invention describe a substrate processing apparatus. An apparatus in accordance with the present invention comprises a processing chamber, a susceptor on which a substrate is to be placed, and a heating unit disposed below said susceptor which heats said substrate placed on said susceptor, wherein said susceptor and said heating unit are accommodated in said processing chamber, said substrate is processed in a state in which said susceptor is rotated relative to said heating unit, at least said susceptor is lifted and lowered in said processing chamber, a lifting and lowering apparatus, disposed in said processing chamber, which lifts and lowers said substrate with respect to at least a portion of said susceptor, and wherein, when said substrate is lifted or lowered, at least with respect to said portion of said susceptor, a distance between said susceptor and said heating unit is maintained constant.

Claim 1

The cited references do not teach nor suggest the limitations of the claims of the present invention. Specifically, the cited references does not teach nor suggest at least the limitation of when said substrate is lifted or lowered, at least with respect to said portion of said susceptor, a distance between said susceptor and said heating unit is maintained constant as recited in the claims of the present invention.

The Office Action contends that MacLeish discloses at Col. 5. lines 34-37 or in lines 35-39, that the distance between the susceptor and the heating unit may be kept constant. However, when the first motor operates to raise the housing and susceptor, and the second motor elevates susceptor 50 away from the housing, the distance between the susceptor and the heating unit must be changed, and therefore cannot be kept constant, since either the first motor or the second motor moves the susceptor with respect to the heating unit. Thus, MacLeish does not teach or suggest that the distance between the susceptor and the heating unit is maintained constant as recited in the claims of the present invention.

Thus, it is submitted that independent claim 1 is patentable over the cited reference. Claims 2 and 4-7 are also patentable over the cited reference, not only because they contain all of the limitations of independent claim 1, but because claims 2 and 4-7 also describe additional novel elements and features that are not described in the prior art.

Claim 13

The cited references do not teach nor suggest the limitations of the claims of the present invention. Specifically, the cited references does not teach nor suggest at least the limitation of wherein said abutting position is provided on a downside of an upper face of said heating unit and is not located between said heating unit and said susceptor as recited in the claims of the present invention.

The Office Action contends that MacLeish discloses in Col. 8, lines 59-63 that the lower part of pin 54 is the lifting and lowering apparatus since this end acts with the housing to lift or lower the substrate and this part in its lowest position gets below surface 46.

However, in Col. 8, line 64-Col. 9, line 9, it is not when the wafer 52 is transferred but when the wafer 52 is cooled that the pins 54 slide into the holes. In transferring the wafer 52, as disclosed in Col. 9, lines 10-18, after the wafer 52 is cooled to approximately 800 degrees C, susceptor 50 is raised a sufficient distance so as to engage and lift pins 54 out of their associated holes formed in the housing 42. Susceptor 50 is then rotated so that pins 54 are no longer aligned with their associated holes formed in housing 42 and then lowered into intimate contact with layer 46. The lower ends of the pins 54 engage the top surface of layer 46 of housing 42 and thereby lift wafer 52 off susceptor 50, and, thus, the abutting portion in transferring wafer 52 cannot be below the surface 46 as recited in the claims of the present invention.

Thus, it is submitted that independent claim 13 is patentable over the cited reference. Claims 14-19 and 25 are also patentable over the cited reference, not only because they contain all of the limitations of independent claim 13, but because claims 14-19 and 25 also describe additional novel elements and features that are not described in the prior art.

Claims 20 and 21

The cited references do not teach nor suggest the limitations of the claims of the present invention. Specifically, the cited references does not teach nor suggest at least the limitation of said substrate being processed in a state in which said susceptor is rotated relative to said heating unit as recited in the claims of the present invention.

The Office Action contends that the Hisashi abstract states that the wafer mounting part has rotary and lifting mechanism and that Fig. 1 shows rotary shaft 13 engaging with the heater 3.

However, the abstract merely reads "A wafer 4 is carried in from a wafer inlet and outlet 8 while the mounting part 12A of a rotary and lifting mechanism 13 is lifted to shift the wafer 4 to the mounting part 13A and then the wafer 4 is shifted to a susceptor 2 by lowering the mechanism 13. Thus, the mounting part which has the rotary and lifting mechanism 13 is the mounting part 13A of the rotary and lifting mechanism 13, which is not a mounting part of the susceptor 2, and thus, Hisashi fails to teach or suggest that the susceptor is rotated, or lifted and lowered, in the processing chamber as recited in the claims of the present invention. Further, the Office Action states that FIG. 1 shows the rotary shaft passing through the heating source 3, not engaged with the heating source 3.

Thus, it is submitted that independent claims 20 and 21 are patentable over the cited reference. Claim 25 is also patentable over the cited reference, not only because they contain all of the limitations of independent claim 20, but because claim 25 also describes additional novel elements and features that are not described in the prior art.

Claim 22

The cited references do not teach nor suggest the limitations of the claims of the present invention. Specifically, the cited references does not teach nor suggest the limitation of a gas introducing position, a substrate processing position, a gas exhaust position and a substrate transferring in and out position is disposed in this order from above as recited in the claims of the present invention.

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The Office Action contends that MacLeish shows gas introduced at the top of the substrates at the time of processing. However, as disclosed in Col. 6, lines 26-27, process gases are fed into reaction chamber 34a via three injection ducts 28, which are lower than the substrates as shown in FIG. 2. Therefore, MacLeish does not teach or suggest at least the limitation of gas introducing position, a substrate processing position, a gas exhaust position and a substrate transferring in and out position is disposed in this order from above as recited in the claims of the present invention.

Conclusion

In view of the foregoing, it is respectfully submitted that the application is in condition for allowance. Reexamination and reconsideration of the application, as amended, are requested. If for any reason the Examiner finds the application other than in condition for allowance, the Examiner is requested to call the undersigned attorney at the Los Angeles, California telephone number (213) 337-6700 to discuss the steps necessary for placing the application in condition for allowance.

If there are any fees due in connection with the filing of this response, please charge the fees to our Deposit Account No. 50-1314.

Respectfully submitted,
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